

EINHORN (MAX)

Therapeutic Results of Direct Electrization of the Stomach

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MAX EINHORN, M.D.

PHYSICIAN TO THE GERMAN DISPENSARY AND INSTRUCTOR IN CLINICAL MEDICINE
AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL

Reprinted from the MEDICAL RECORD of January 30 and February 6, 1892



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THERAPEUTIC RESULTS OF DIRECT ELECTRIZATION OF THE STOMACH.¹

IN a paper entitled "A New Method for Direct Electrization of the Stomach,"² read before the New York Academy of Medicine on March 25, 1891, I promised to give more detailed results of the physiological and therapeutic action of this method at a later opportunity.

By the introduction of the deglutable stomach electrode direct gastro electrization has been, in fact, simplified and greatly facilitated. Thus I was enabled to treat quite a large number of patients by this method, and to make several experimental investigations besides.³

Notwithstanding that my work on this subject cannot as yet be regarded as completely finished, I would now like to communicate the results already obtained, for I trust that they will prove of value in therapeutics, and a supplement to this paper can be issued without any inconvenience at a later period.

The literature of electrization of the stomach I have discussed pretty fully in the above-mentioned paper, but

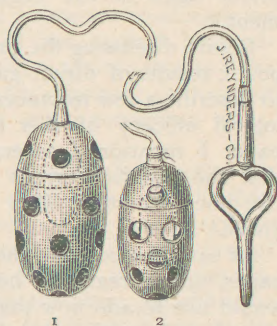


FIG. 1. — Deglutable Electrode, large size. FIG. 2. — Deglutable Electrode, small size.

¹ Read before the Medical Society of the County of New York, December 28, 1891.

² New York MEDICAL RECORD, May 9, 1891.

³ Lately I have made the electrode a little smaller than that demonstrated in the Academy meeting (see figure), and its use has become still more convenient.

there are yet some points to be added in reference to direct electrization of the stomach which will be done later at the proper place.

In the administration of electricity I have made use of the two electric currents most commonly employed in medicine, viz., the faradic and the galvanic. As there were no rules when to use the one or the other kind of current, I in the beginning applied almost exclusively the faradic, this electric resource being most easily handled and found everywhere, only where there was no result whatever, or only a slight one obtained by faradization, did I take up the galvanic current. After a while, however, I thought that I had discovered one indication for the application of the galvanic current, and therefore administered galvanization at once in appropriate cases in the beginning of the electrical treatment.

Before discussing the proposed subject, viz., the therapeutic results of direct gastro-electrization, I would like to describe a few instances which bear upon the physiological efficacy of this means. In the above-named paper I mentioned several experiments which showed that the faradic current increases the amount of gastric juice secreted. This has been verified by Allen E. Jones.¹

As can be seen from the experiments mentioned in my paper, the increase is, however, not very large, and I would like to add now that this increase must not be expected with mathematical certainty. Meanwhile, I had the opportunity to observe a case where the degree of acidity after faradization was lower than before. Here many factors enter into play, which sometimes are not very easily seen and taken into consideration. I think, however, I may conclude from my further experiments that the faradic current generally increases the gastric secretion. The question arises, How does the galvanic current act? In order to decide this the same experi-

¹ MEDICAL RECORD, June 13, 1891.

ments with direct faradization related in the above mentioned paper were now executed with direct gastro-galvanization on healthy and sick people.

The method consisted in examining each individual, first when fasting, by means of a stomach-tube, in order to ascertain whether the stomach was empty or not; the contents occasionally found there were removed. Then each one of them drank 100 c.c. of water and swallowed the electrode, electricity, however, not being applied. After ten minutes the electrode was withdrawn, and the stomach contents withdrawn by means of a tube, and examined to determine the amount of hydrochloric acid and the degree of acidity. After this the subject drank again the same quantity of water, and the stomach was now galvanized (the deglutable electrode being in the stomach, the other beneath the processus ensiformis on the epigastrium), the strength of the current being always about fifteen milliamperes, very seldom twenty; the duration of the application was ten minutes; the current was applied constantly without any interruption whatever.

After the galvanization the contents of the stomach were obtained, examined, and compared with the first portions. The influence of the positive and negative poles upon the stomach in reference to the secretion of juice was also determined. In several trials comparative examinations were made on the same individual as to the effect of the galvanic and faradic currents on the secretion of gastric juice. The experiments made for this purpose were divided into two groups:

I. The behavior of the galvanic current applied to the inner stomach-wall in people without any digestive troubles.

1. F. R.—, aged twenty-seven, servant. *a.* August 22, 1891.—*a.* Fasting condition; drinks 100 c.c. of water and swallows the electrode, which is left in the stomach for ten minutes. By means of a tube 95 c.c. of the stomach contents are obtained. Reaction acid;

HCl = 0 ; acidity = 12 ;¹ propeptone = 0 ; peptone, biuret reaction + (faint) ; Lugol's solution remains unchanged ; Uffelmann's reagent (weak solution of carbonic acid + ferr. sesquichlorat.) becomes discolored, but not to a straw-yellow ; rennet ferment + (equal parts of the filtrate and milk, after fifteen minutes almost firmly coagulated, after an hour absolutely firm coagulation).

β. Drinks again 100 c.c. of water and is galvanized for ten minutes, negative pole being in the stomach. By means of a tube 85 c.c. obtained. Reaction, faintly acid ; HCl = 0 ; acidity = 6 ; propeptone = 0 ; biuret reaction + ; Lugol's solution unchanged ; Uffelmann's reagent discolored but not straw-yellow. In order to produce the discoloration of the U. reagent a much larger portion has to be added from *β* than from *α* ; rennet ferment = 0 (?) (equal parts of filtrate and milk, after fifteen minutes unchanged ; after an hour still unchanged ; after six hours unchanged ; on the following day coagulated in very fine, not coherent curdles).

δ. August 25th.—Drinks in a fasting condition 100 c.c. of water and is galvanized for ten minutes (the negative electrode being in the stomach). 115 c.c. of a clear watery fluid mixed with a little mucus obtained : Reaction — faintly acid ; HCl = 0 ; acidity = 2 ; rennet = 0.

[In this and in the following trial the control-test of swallowing the deglutable electrode without galvanization has been omitted, as it was too troublesome for Mr. F. R.— to undergo all the necessary procedures so often in succession.]

c. August 27th.—Drinks while fasting 100 c.c. of water and is galvanized for ten minutes ; negative electrode in the stomach. By means of a tube 60 c.c. obtained : HCl + weak ; acidity = 16 ; rennet + . In order to ascertain the chemical function of the stomach

¹ The degree of acidity was always expressed by the amount of c.c. of a one-tenth standard sodium-hydrate solution necessary to neutralize 100 c.c. of the filtrate.

in this individual the contents of his stomach were examined again, one hour after a cup of tea and a roll had been partaken of: $\text{HCl} +$; acidity = 80. The acidity found was higher than normal; but whether this was the result of the several experiments made on the stomach of F. R.—during the latter part of August, or whether his stomach usually works this way, is hard to tell. In fact, we have no exact standard from which we could deduce that this is the normal. I think the normal varies in a certain degree with each individual. We can, however, speak of a normal standard found by averaging the majority of cases.

2. George N. I——, aged forty-five, at present free from any distress from the digestive organs.

a. October 6, 1891.—*a.* While fasting (had partaken one hour previously of a glass of water) 60 c.c. of water obtained by means of a tube: $\text{HCl} +$; acidity = 68.

β. Drinks 100 c.c. of water and swallows the electrode, which is left in the stomach for ten minutes; thereupon the electrode is withdrawn, and the contents of the stomach (90 c.c.) obtained: $\text{HCl} +$; acidity = 10. *γ.* Drinks 100 c.c. of water and is gastro-faradized internally for ten minutes. Obtained contents = 90 c.c.: $\text{HCl} +$; acidity = 13.

b. October 15th.—*a.* When fasting (one hour after a glassful of water). Obtained contents about 50 c.c.: $\text{HCl} +$; acidity = 22. *β.* Drinks 100 c.c. of water and swallows the electrode, which is left in the stomach for ten minutes. Obtained contents = 80 c.c.: $\text{HCl} = 0$; acidity = 4. *γ.* Drinks 100 c.c. and is galvanized for ten minutes (negative pole in the stomach). Obtained contents = 130 c.c.: $\text{HCl} = 0$; acidity = 2.

3. Rose N——, about twenty-seven years of age, being in perfect health, servant.

a. August 11, 1891.—Drinks when fasting 100 c.c. of water and is galvanized for ten minutes (negative pole being in the stomach). By means of a tube 120 c.c.

of the contents are obtained : reaction, slightly acid ; $\text{HCl} = 0$; acidity = 4 ; rennet ferment = 0.

b. August 12th.—Drinks, when fasting, 100 c.c. of water and is galvanized for ten minutes (positive pole in the stomach). By means of a tube only 30 c.c. of a yellowish fluid are obtained : reaction, slightly alkaline ; rennet ferment = 0 ; a slice of hard-boiled egg albumin put into this liquid is digested in three hours. Here the greater part of the water seems to have already disappeared from the stomach, either by resorption, or by finding its way to the small intestines ; the obtained contents consisted mainly of the bile and duodenal secretion, as shown by the reactions described.]

c. August 25th.—Drinks while fasting 100 c.c. of water and is gastro-faradized internally for ten minutes. Only 40 c.c. could be obtained : reaction, slightly acid ; $\text{HCl} = 0$; acidity = 4 ; Rennet ferment = 0. The circumstance that after the internal gastro-faradization no HCl had been found in the contents of the stomach caused me to examine the chemical function of the stomach one hour after Ewald's test-breakfast.

November 7th.—One hour after breakfast : $\text{HCl} = 0$; acidity = 24 ; rennet +.

In this way it seems quite apparent that the last person, although in perfect health, did not furnish a normal chemical condition of the stomach ; therefore the results obtained by direct electrization in this case cannot be of any value for the purposes in question. This case, however, is interesting in as far as it shows that, notwithstanding such anomaly in the secretion of the stomach (absence of free hydrochloric acid and very low acidity), a person can be in perfect health.

In a fourth perfectly healthy individual the same experiments in reference to the efficacy of internal gastro-electrization were made. But very little of the stomach contents could be obtained, even after several trials ; the person had to make use of abdominal pressure quite a long time and with force. These results are, according

to my opinion, unfit to be made use of, for the reason that the irritation from the tube during strained expressure undoubtedly caused a certain amount of gastric juice to be secreted ; therefore I think it preferable to omit the experiments referring to this individual.

II. The behavior of the galvanic current applied to the internal stomach-wall in those with digestive troubles.

1. Theodore S——, forty-seven years of age, suffering with dilatation of the stomach with hyperacidity.

a. September 29, 1891.—When fasting the stomach was found to be empty. *a.* Drinks 100 c.c. of water and swallows the electrode which is left in the stomach for ten minutes. 50 c.c. of the contents : HCl + ; acidity = 12. *β.* Drinks 100 c.c. of water and is galvanized for ten minutes (negative pole in the stomach). 70 c.c. obtained : HCl = 0 ; acidity = 5.

b. September 30th.—When fasting, stomach empty. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes, the contents obtained = 30 c.c. : HCl + ; acidity = 16. *β.* Drinks 100 c.c. of water and is galvanized for ten minutes (positive pole in the stomach). 150 c.c. obtained : HCl + ; acidity = 16.

c. October 1st.—When fasting, stomach empty. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes the contents obtained = 70 c.c. : HCl + ; acidity = 18. *β.* Drinks 100 c.c. of water and is faradized for ten minutes. Obtained 70 c.c. : HCl + ; acidity = 18.

2. Jacob M——, twenty-four years of age. Diagnosis : Anæmia, dilatation of the stomach, hyperacidity, enlarged spleen in consequence of previous malaria.

a. October 13th.—When fasting the stomach contains 20 to 30 c.c. of a viscid, opalescent, turbid fluid, of a slightly alkaline reaction. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes, contents obtained = 100 c.c. : HCl + (traces) ; acidity = 10. *β.* Drinks 100 c.c. of water and is galvanized for ten min-

utes (negative pole in the stomach). Obtained 120 c.c. : HCl = 0; acidity = 12.

b. October 16th.—When fasting, only 5 c.c. withdrawn, the reaction being slightly alkaline. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes obtained 115 c.c. (about 15 c.c. of mucus): HCl + (traces); acidity = 12; rennet ferment +. *β.* Drinks 100 c.c. of water and is gastro-faradized internally for ten minutes. Obtained 100 c.c. (about 15 c.c. of mucus): HCl + (well marked); acidity = 14; rennet +.

c. November 5th.—When fasting, only a few c.c. found in the stomach with HCl = 0; reaction, weakly acid. *a.* Drinks 100 c.c. of water and is galvanized for ten minutes (negative pole in the stomach). Obtained 40 c.c. : HCl = 0; acidity = 2; rennet ferment coagulation after one hour.

d. November 8, 1891.—When fasting, about 20 c.c. : HCl +. *a.* Drinks 100 c.c. of water and is galvanized (positive pole in the stomach). Obtained 60 c.c. : HCl +; acidity = 24. *β.* Drinks 100 c.c. of water and is faradized directly for ten minutes. Obtained 120 c.c.; the fluid turns green after standing a little while; this indicates an admixture of bile : HCl +; acidity = 24.

3. Aaron W——, thirty-three years of age; dilatation of the stomach, hyperacidity.

a. November 14th.—When fasting, about 20 c.c. : reaction acid; HCl = 0. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes the contents obtained = 100 c.c. (with a greenish color of admixed bile): HCl +; acidity = 20.¹ *β.* Drinks 100 c.c. of water and is galvanized for ten minutes (negative pole in the stomach). Obtained 50 c.c. : HCl +; acidity = 20.

b. November 27th.—When fasting, 20 c.c. : reaction, very faintly acid; HCl = 0. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes, ob-

¹ The degree of acidity of the contents must have been lessened by the admixture of the bile, and would have been higher otherwise.

TABLE CONTAINING THE DIFFERENT TRIALS IN REFERENCE TO THE BEHAVIOR OF THE DIRECT GALVANIZATION OF THE STOMACH.

I.—IN PEOPLE WITHOUT ANY STOMACH COMPLAINTS.

No.	Name.	Age (Years).	Date.	Nature of the experiment.	HCl.	Acidity.	Remarks.
1	Franz R.....	27	August 22, 1891....	Control experiment.....	o	12	Rennet = o.
	".....	"	" 25, 1891.....	Galvanization negative....	o	6	
2	".....	"	" 27, 1891.....	Galvanization negative....	o	2	
3	".....	"	" 27, 1891.....	Galvanization negative....	+ weakly.	16	
4	George N. J....	45	October 6, 1891....	Control experiment.....	+	10	Reaction weakly alkaline by the admixture of duodenal secretion.
	".....	"	" 15, 1891.....	Faradization.....	+	13	
5	".....	"	" 15, 1891.....	Control experiment.....	o	4	
	".....	"	" 15, 1891.....	Galvanization negative....	o	2	
6	Rosa N.....	27	August 11, 1891....	Galvanization negative....	o	4	
	".....	"	" 12, 1891....	Galvanization positive....	o	—	
	".....	"	" 25, 1891....	Faradization.....	o	4	

II.—IN PEOPLE WITH STOMACH COMPLAINTS.

No.	Name.	Age (Years).	Date.	Nature of the experiment.	HCl.	Acidity.	Remarks.
1	Theodore S....	47	September 29, 1891.	Control experiment.....	+	12	
	".....	"	" 30, 1891.	Galvanization negative....	o	5	
2	".....	"	" 30, 1891.	Control experiment.....	+	16	
	".....	"	" 30, 1891.	Galvanization positive....	+	16	
3	".....	"	October 1, 1891....	Control experiment.....	+	18	Rennet +. Rennet +. Rennet ferment coagulation after one hour.
	".....	"	" 13, 1891....	Faradization.....	+	18	
4	Jacob M.....	24	" 13, 1891....	Control experiment.....	+ traces.	10	
	".....	"	" 16, 1891....	Galvanization negative....	o	12	
5	".....	"	" 16, 1891....	Control experiment.....	+ traces.	12	The contents looked greenish from an admixture of bile.
	".....	"	" 16, 1891....	Faradization.....	+ clearly.	14	
6	".....	"	November 5, 1891..	Galvanization negative....	o	2	
	".....	"	" 8, 1891..	Galvanization positive....	+	24	
	".....	"	" 14, 1891..	Faradization.....	+	24	
7	Aaron W.....	33	September 14, 1891.	Control experiment.....	+	20	
	".....	"	" 24, 1891.	Galvanization negative....	+	20	
8	".....	"	November 24, 1891.	Control experiment.....	o	4	
	".....	"	" 27, 1891.	Galvanization negative....	+ traces.	16	
9	".....	"	" 27, 1891.	Control experiment.....	+ traces.	10	
	".....	"	" 30, 1891.	Galvanization negative....	+ traces.	10	
10	".....	"	" 30, 1891.	Control experiment.....	+	18	
	".....	"	" 30, 1891.	Galvanization negative....	+	32	

tained 95 c.c. : HCl = 0 ; acidity = 4. β . Drinks 100 c.c. of water and is galvanized for ten minutes (negative pole in the stomach). Obtained 60 c.c. : HCl + (traces); acidity = 16.

c. November 27th.—When fasting, 10 c.c. : HCl +. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes obtained 100 c.c. : HCl + (traces); acidity = 10. β . Drinks 100 c.c. of water and is galvanized for ten minutes (negative pole in the stomach). Obtained 100 cc. : HCl + (traces); acidity = 10.

d. November 30th.—When fasting, 25 c.c. stomach-juice : HCl +. *a.* Drinks 100 c.c. of water and swallows the electrode. After ten minutes, obtained 70 c.c. : HCl + ; acidity = 18. β . Drinks 100 c.c. of water and is galvanized for ten minutes (negative pole in the stomach). Obtained 100 c.c. : HCl + ; acidity = 32.

The annexed table shows the results of all the trials just described.

From this experimental table it seems that direct galvanization of the stomach—the negative pole being within this organ—does not heighten the secretion of gastric juice ; it seems rather to have a tendency to diminish the degree of acidity in healthy as well as in those with stomach troubles ; *i.e.*, the presence of the electrode in the stomach without galvanization produces in a given time more gastric secretion (or rather acid) than the presence of the electrode combined with galvanization (negative pole in the stomach). This, however, was not the case in the patient Aaron W—— (Table II., 8 and 10), where an increase of acidity was twice observed. The experiments made with galvanization, the positive pole being in the stomach, were very few, and once the degree of acidity was found equal to that in the control experiment (Table II., 2). At another time the patient was examined, first with the negative pole in the stomach, then with the positive pole in the stomach (Table II., 6) ; here the acidity was higher when the positive pole was in the

stomach than when the negative pole was there ; but there was no control experiment made.

These experiments with direct galvanization are not numerous enough to allow any positive conclusions to be drawn and will have to be completed in the future.

The figures obtained, however, are not in accordance with the views of Allen E. Jones,¹ that the constant current applied directly to the stomach produces a secretion of hydrochloric acid (no difference being noticed whether the positive or negative pole be in the stomach). The reason for the divergence of opinion might perhaps be found in the circumstance that Jones made use in his experiments of the Stockton electrode, which, in the same way as the ordinary stomach-tube, must act as a potent irritant on the stomach-wall. Jones states, however, that he did not find any hydrochloric acid in his control experiments.

Whereas the faradic current in these experiments seems to augment the gastric secretion, the galvanic current appears rather to exert a slightly diminishing action in the production of gastric juice, especially when the negative pole is in the stomach. Should we wish to utilize therapeutically these experimentally obtained conclusions, we would expect theoretically that the faradic current would be more advisable in cases of subacidity, whereas the galvanic current would be preferable in cases of hyperacidity. But in reality we shall see later on that this cannot be made an axiom for the therapeusis. There were cases of hyperacidity which greatly improved by the faradic treatment, and on the other hand there were cases with subacidity in which the faradic current did not bring much benefit and the galvanic current proved very useful.

My above-mentioned experiments are all made for the purpose of seeing what electricity does right away, *i.e.*, during the electrization itself. It will certainly be important to determine what the stomach does a little while

¹ Jones, loc. cit.

after the electrization. Experiments relating to this point I shall make later on.

After this long deviation I would like to return to my proposed subject, namely, to the therapeutic efficacy of direct electrization of the stomach.

A. Direct Faradization of the Stomach.—As stated in my last paper,¹ direct gastro-faradization has been applied from time to time by several authors, although quite seldom. There is very little literature to be found in regard to this subject. I highly appreciate the work of Charles G. Stockton,² who applied direct gastro-faradization in a great number of cases (dilatation of the stomach and many functional disturbances of this organ going along with hyperacidity and also subacidity), and warmly recommended this method of treatment. In his elaborate paper Stockton, trying to give an explanation for the efficacy of electrization, says :

“ Exactly what rôle is played by faradization I am unable to state ; whether it is a gastric sedative or a gastric stimulant I do not know. My efforts were in the direction of study, and the results were so favorable that I applied faradism to cases seemingly contradictory in character, and I have concluded that the great variety of gastric neuroses depend upon a common cause—an imperfect innervation of the stomach ; that electricity improves this innervation, thereby relieving the cause and so the conditions which, at first thought, are so contradictory.”

As the subject of direct gastro-faradization is quite new and very important in practice, I do not think it superfluous to describe and fully discuss a sufficient number of cases representing the various types of stomach diseases treated by this method.

In all my cases the deglutable electrode was made use of and the method of application was the same as I gave it in the above-mentioned paper.

¹ M. Einhorn, *MEDICAL RECORD*, loc. cit.

² Clinical Results of Gastric Faradization, *American Journal of the Medical Sciences*, 1890, p. 20.

From June, 1890, to November, 1891, I have had the opportunity of undertaking this mode of treatment by direct gastro-faradization in 29 patients. The same may be classified as regards their diseases as follows: Hyperacidity combined with dilatation of the stomach, 12 (among these, three with severe gastralgia and one with continuous hypersecretion); gastroxynsis, 1; belching, atony of the cardia, 3; chronic gastric catarrh (gastritis glandularis chronica), 4; chronic gastric catarrh with beginning atrophy of the mucous membrane of the stomach, 3; anadenia ventriculi (atrophy of the mucous membrane of the stomach), 1; severe gastralgia, 5; (one among them with gastro succorrhœa continua chronica).

1. *Hyperacidity*.—March 12, 1891.—H. J. F——, thirty-three years of age, merchant, suffered for about three years from pains after meals. For several months the distress after eating increased to such an extent that the patient was forced to (spontaneously) produce vomiting after each meal, in order to obtain some relief in this way. The appetite was very poor. The examination showed the lower border of the stomach situated midway between the umbilicus and the symphysis.

March 13th.—The examination of the stomach contents one hour after the test breakfast shows: HCl +; acidity = 96. Diagnosis: Dilatation of the stomach, hyperacidity, and gastralgia. Besides the usual treatment with alkalies the patient was gastro-faradized internally. After the third electric séance the patient noticed that the pains had grown less and that he ate with good appetite on the days when electricity was applied. In about a month's time (at the beginning of April) the condition of the patient had been ameliorated to such a degree that he had no pains and could enjoy his meals thoroughly. According to a letter which he sent me on October 24, 1891, he had been free from pains and enjoyed good health since the time of the electrical treatment.

2. August 15, 1890.—Julius K——, aged thirty-six, laborer; suffered for about three years from obstinate con-

stipation ; with this he has headaches and a sensation of fulness in the stomach. No vomiting. There is constant repeating, sometimes of water, in such a way that the patient's throat has become roughened by it. He has lost forty-five pounds in weight. Examination shows the lower border of the stomach situated two to three fingers' width below the navel. When fasting, gastric juice is present in the stomach.

September 16th.—When fasting, the stomach contains 60 c.c. of juice : HCl + ; acidity = 90.

September 18th.—One hour after test-breakfast : HCl + ; acidity = 100. Diagnosis : *Gastrosuccorrhœa continua chronica* ; hyperacidity ; dilatation. Therapy : magnes. ust., pulv. rhei, $\bar{a}\bar{a}$ 7.5 ; sodii bicarb., sacch. lact., $\bar{a}\bar{a}$ 25.0. One teaspoonful three times a day ; washing of the stomach.

After this treatment, chiefly with alkalies, the condition of the patient was ameliorated, but there remained the feeling of fulness. Gastro-faradization was applied internally twice a week for about two months (August and September, 1890). After a few sittings the patient asserts that he feels much easier ; he gains in weight and the distress after meals does not manifest itself. The objective examination shows, however, that there is still hyperacidity and hypersecretion, although in a less degree.

3. T. E. H——, thirty years of age, merchant ; has digestive troubles of several years' standing ; there is loss of appetite, very frequent repeating ; pains from time to time ; feeling of fulness after meals ; constipation.

The examination reveals : lower border of the stomach three to four fingers' width below the navel (gastrodiaphragm) ; here splashing can be elicited. One hour after test-breakfast : HCl + ; acidity = 120. .

Therapy : Alkalies and direct gastro-faradization (April 1 to 26, 1891). After a few days of this treatment the condition of the patient becomes ameliorated ; he enjoys his meals ; bowels regular ; repeating lessened.

April 26th the patient asserts that he is free from any trouble whatsoever.

Eight other cases so much resemble the three cases just described, as regards the symptoms as well as the treatment and the influence of faradization, that I may be allowed to abstain from giving a full record of them.

II. *Gastroxynsis* (Rossbach).—August 31, 1890.—George N. J.—, forty-two years of age, merchant, suffered for five years from frequently appearing attacks of pains in the region of the stomach; these attacks were usually accompanied by vomiting of highly acid substances; they recurred once every three to four weeks and lasted about three days. During the attack the patient felt miserable and down-hearted, suffered from severe pains; was not able to eat anything and vomited frequently. When the attack was over the patient felt perfectly well, except that his sleep was somewhat disturbed. The physical examination shows: Chest and abdominal organs intact; the patellar reflex present; stomach not dilated (the site of the stomach having been determined by gastrodiaaphany).

August 31, 1891.—One hour after test-breakfast, HCl +; acidity = 66. Diagnosis: *Gastroxynsis* (Rossbach).

Treatment: The patient was directly gastro-faradized every other day during September, and twice a week during October, 1891. He had no attack during the time of treatment, nor any thus far after the treatment; sleeps well, and feels stronger and full of life.

III. *Repeating*.—Repeating is a symptom which occasionally appears and accompanies the most various disturbances of the stomach-function. Here, however, a few cases might be described in which this symptom was the main complaint and overshadowed all other distress.

1. October 7, 1890.—Henry L.—, forty years of age, suffered several years from frequent repeating; during the last year the repeating increased to such a degree that the patient was partly unable to attend to his business; be-

sides this, he had for several months the sensation of fullness after meals and a tired feeling ; appetite pretty fair ; bowels somewhat constipated. Status præsens : chest intact ; the palpation of the abdomen reveals splashing sounds in the gastric region ; these sounds can be produced and heard down to a point two fingers above the navel.

October 10, 1890.—One hour after a test-breakfast : $\text{HCl} +$; acidity = 80.

Diagnosis : Hyperacidity and atony of the cardia.

Treatment : Alkalies and direct gastro-faradization twice to three times every week.

After a few sittings the patient felt better, and on November 6, 1890, the electrical treatment was discontinued. The patient said several months afterward that he had not been troubled any more from repeating after the discontinuation of the electricity.

June 4, 1891.—The patient called on me again, complaining of distress in his stomach in consequence of an acute indigestion ; the appetite was lessened and the repeating had partly returned. The patient was directly gastro-faradized twice a week from June 4th to June 19th and thereafter only once a week until July 27th. The distress of the patient, especially the repeating, disappeared during the first fortnight's treatment ; the electricity was applied, however, a little longer as a means of precaution. Since that time the patient has been free from his complaints.

2. Miss Emma M——, twenty-four years of age, suffered for three years from loss of appetite, repeating, constipation, and poor sleep ; there was no vomiting but repeating of acid fluid after meals. One of the worst complaints of the patient was of this highly annoying ructus, which never left her, and in consequence of which she was retarded in her occupation and frequently kept away from society.

April 1, 1891.—Status præsens : Tongue thickly coated ; splashing sound from the stomach to a point

two fingers' breadth below the navel; the right kidney is clearly palpable and easily moved. Examination of the stomach in the fasting condition by means of a tube shows that there is bile mixed with gastric juice in the stomach; also after the trial breakfast the contents of the stomach were usually found mixed with bile, as will be seen from the following memorandum:

April 3d.—One hour after the trial-breakfast: HCl +; acidity = 68; admixture of bile.

April 5th.—When fasting, the stomach contains 70 cc. of an intensely yellow-colored fluid (bile present): HCl +.

Diagnosis: Enteroptosis; acidity only slightly increased, hypersecretion; relaxation (atony) of the cardia and the pylorus.

The treatment consisted in direct gastro-faradization and once in a while washing of the stomach. During the month of April the faradization was applied every other day, and the lavage of the stomach once a week in the fasting condition. On these occasions, before the washings, the stomach was examined each time in regard to its contents; during April each examination revealed the presence of quite a large amount of bile mixed with gastric juice in the stomach when fasting. Later on the amount of fluid found when fasting gradually decreased, and during June the stomach was found to be either empty or there were occasionally a few cubic centimetres of gastric juice, but without the admixture of bile. The patient felt better after a few days' treatment; the repeating disappeared almost entirely at the end of April, and she could eat with good appetite, having no distress afterward.

During June and July the faradization had been applied once a week and thereupon stopped entirely. The patient gained several pounds during treatment, and has been pretty free from complaints since that time.

3. Mrs. H. G.—, about forty-three years of age, complained for several years of a feeling of fulness, poor ap-

petite, and frequent repeating. Whereas all the other digestive inconveniences manifest themselves for a longer period of time, the repeating never ceases entirely, and annoys the patient more than the other symptoms.

Status præsens : Patient looks well-nourished and of a healthy color ; tongue slightly coated ; chest normal ; palpation of the abdomen does not reveal anything abnormal, except, perhaps, a certain sensitiveness on pressure over the gastric and epigastric regions. One hour after the test-breakfast : HCl + ; acidity = 50 ; lactic acid +. The stomach contents mixed with much mucus.

Diagnosis : Gastritis glandularis chronica ; atony of the cardia.

The treatment consisted of the administration of nuxvomica and direct gastro-faradization, at first every other day, and thereafter twice a week from September 16 to October 23, 1891. After a week's treatment considerable amelioration was noticeable, inasmuch as the appetite had improved and the repeating decreased. October 13th the patient had no complaints from the digestive apparatus and the repeating had disappeared almost entirely. The tongue was clean and the examination of the stomach contents one hour after the test-breakfast showed : HCl + ; acidity = 60 ; lactic acid not present ; the amount of mucus very slight.

IV. *Chronic Gastric Catarrh (Gastritis Glandularis Chronica)*.—Besides the last case of chronic gastric catarrh mentioned under the sub-heading "Repeating," four cases of this sickness were treated by direct gastro-faradization.

One of these cases was Captain L. M——, suffering from neurasthenia and chronic gastric catarrh, accompanied by dilatation. Here the direct gastro-faradization had been administered for about a month, but without any benefit whatever ; all the symptoms continued just as before. The other three cases resembled each other very much and the report of one of them will be sufficient as an illustration.

September 18, 1891.—Mrs. L. W——, about twenty-six years of age, suffered for about four years from frequently recurring digestive disturbances (poor appetite, pains in the region of the stomach and in the abdomen); she had been treated by several competent physicians, sometimes with good results. During the last summer the general health of the patient was impaired; the complaints, however, greatly increased during the past six weeks; there appeared pains in the region of the stomach, the patient could not eat sufficiently, for soon after partaking of the food she had a sensation of being laced; she could not sleep, and suffered much from repeating and flatus; during the summer she lost in weight considerably.

Status præsens: Patient has a pale appearance and frail structure; color of lips and cheeks pale; tongue coated; chest organs normal; abdominal wall relaxed; the abdomen slightly distended; the epigastric region somewhat painful on pressure; the splashing sound can be produced below the left margin of the ribs down to a point three fingers' width above the navel.

September 19th.—One hour after the test-breakfast: $\text{HCl} = 0$; lactic acid +; acidity = 60; erythrodextrin + much; mucus present.

September 22d.—When fasting, stomach is found empty; lavage brings up very little mucus.

Diagnosis: Gastritis glandularis chronica.

Treatment: Nux vomica, HCl , gymnastics, cold washing and rubbing of the body, and direct gastro-faradization, the first fortnight every other day and thereafter twice a week (the faradization was applied from September 23, to October 20, 1891).

Soon after the beginning of this treatment the patient felt better; she could partake of more food; the pains first decreased in severity, and soon disappeared almost entirely. The patient gained during treatment (six to seven pounds) and obtained a good and healthy color.

October 1st.—The examination of the stomach con-

tents one hour after breakfast showed : HCl + ; lactic acid = 0 ; acidity = 56. The muriatic acid was discontinued, and arsenic and iron given instead.

October 23d.—The examination of the stomach contents one hour after the test-breakfast showed : HCl + ; lactic acid not present ; acidity = 60. Notwithstanding there were now no complaints from the stomach, the patient had once in a while (once in from five to seven days) a pain appearing at a place located two fingers' width below the lower margin of the left ribs, and lasting for about half an hour. In order to combat this the galvanic current had been applied, negative pole in the stomach, the positive electrode at the painful spot. November 2d, the patient asserted that the pain appeared only once after galvanization and was very mild.

V. *Chronic Gastric Catarrh with Beginning Atrophy of the Mucous Membrane of the Stomach.*—1. Johann K.—, twenty-seven years of age, complained for four years of a poor appetite, of a sensation and fulness after meals ; suffers greatly from repeating ; there is vomiting once in a while ; bowels constipated.

October 31, 1890.—Status præsens : Patient pretty thin ; chest normal ; the stomach reaches to midway between the navel and the symphysis (tested by the gastro-diaphan and by the splashing sounds that can be produced) ; the stomach region is not sensitive on pressure.

November 2, 1891.—The examination of the stomach contents one and a half hour after the test-breakfast shows : HCl = 0 ; acidity = 34 ; rennet ferment +. Repeated examinations after the test-breakfast always gave about the same results, *i.e.*, the absence of free HCl.

Diagnosis : Gastritis glandularis chronica ; atrophica mucosæ incipiens ; dilatatio ventriculi.

The treatment consisted in direct gastro-faradization (October 31 to November 16, 1890, and April 13 to 26, 1891), besides the other usual therapeutic measures. The complaints of the patient soon ceased ; his appetite improved and he had no repeating. As mentioned above,

free hydrochloric acid could not be detected here after the test-breakfast.

On November 16, 1890, a trial was made to ascertain whether faradization would induce the stomach to secrete a sufficient quantity of HCl for its positive detection. With this end in view the patient was given while fasting 300 c.c. of water and was directly gastro-faradized for ten minutes; twenty-five minutes later a portion of the water was taken from the stomach; it looked greenish in color due to a small quantity of bile. The analysis showed: HCl +; acidity = 16.

In this way it was possible to prove that the faradic current in this particular patient, in whom otherwise free hydrochloric acid could not be found, produced a secretion of gastric juice with the presence of free hydrochloric acid.

The patient felt quite well during the whole winter after the treatment. On April 13th, however, the electrical treatment had to be resumed, on account of reappearing digestive troubles, but on April 26th the patient was dismissed as improved. The chemical condition of the stomach, however, has not visibly changed, in so far as there cannot be found even now free HCl one hour after the test-breakfast.

2. March 14, 1891.—August S—, thirty-two years of age, complained for about three and a half years of obstinate constipation and pains in the gastric region, radiating to the spine and to the shoulders; has lost fifteen pounds during this sickness; there is no vomiting; appetite always fair; stomach largely distended; splashing sound down to a point two or three fingers' breadth below the navel; sleep good; during night the patient is no way troubled; tongue slightly coated.

March 15th.—Two hours after the test-breakfast nearly the whole quantity of the meal was obtained. The analysis showed: HCl = 0; acidity = 20; rennet ferment + (several other examinations showed again the absence of the free HCl after the test-meals).

Diagnosis : Gastritis glandularis chronica with dilatation ; beginning atrophy probable.

Besides HCl and a few washings of the stomach in the beginning, the direct gastro-faradization had been applied from March 15th to April 19th. The patient grew better, inasmuch as the pains ceased, but the examination of the stomach contents one hour and a half after the test-breakfast showed, on April 17th, HCl = 0; acidity = 22; rennet ferment +. Thus there was no substantial change in the chemical condition of the stomach.

3. February 21, 1891.—Henry K——, thirty-three years of age, suffered for ten or fifteen years from “spitting of water.” By this phrase the patient meant to express the belching of a considerable amount of a tasteless fluid from the stomach into the mouth, which he then expectorated every day or at least every other day. Sometimes this occurred ten or twelve times during the day. For the last eight or nine months the patient had this spitting after each meal. Appetite never good, although the patient could partake of each meal. When a boy he was strong and stout, but has been thin since his twentieth year. Sleep good; bowels moved every other day, but not regularly. During the last thirteen years there has been from time to time vomiting (*i.e.*, the ejection of the whole meal). Before the vomiting the patient had a sensation of oppression.

The physical examination of the chest organs reveals nothing abnormal. The stomach reaches down to within two fingers' width of the symphysis, as shown by gastro-diaphany and splashing sounds.

February 22d.—One hour after the test-breakfast : HCl = 0; acidity = 14; rennet ferment +. (Similar results have been obtained by examination on several other occasions.)

Diagnosis : Dilatatio ventriculi; gastritis glandularis chronica; regurgitatio; atrophia incipiens.

After direct gastro-faradization (from February 21st to

March 26th every other day, and during April, 1891, once a week), and occasional lavage of the stomach, the patient's condition was ameliorated; "the spitting" greatly diminished (it now occurred only about once every other day), the appetite improved, and the patient felt stronger. Examinations of the stomach contents were made quite frequently; they always showed, however, nearly the same results; free hydrochloric acid was absent, but the ferments of the stomach, pepsin and rennet, were found to be present; the acidity was always very low, and varied from 14 to 22. Only once it was possible to detect the presence of free hydrochloric acid in traces; namely, on February 27, 1891, one hour after the test-breakfast, after ten minutes of direct gastro-faradization the acidity was = 22.

At the end of the treatment the patient did not believe that he had gained in weight; the bowels moved regularly every day and the spitting had almost entirely ceased. This amelioration lasted even after the discontinuation of the treatment. I saw the patient again on November 3, 1891, and he reported that the "spitting" had not reappeared and that the bowels moved regularly every day.

Atrophy of the Mucous Membrane of the Stomach.—In the case of atrophy of the mucous membrane of the stomach, which had improved under lavage and a suitable mode of life, direct gastro-faradization was applied; this produced about the same result as the lavage of the stomach. The faradization in this case shows little that is noteworthy, and I have given a full report of this case, which is very interesting from the clinical point of view, in the *New York Medicinische Presse*.¹

Whereas in all above described cases (with the exception of Captain L. M——, Sub. IV.) after the frequent application of direct gastro-faradization there was a decrease, or rather a disappearance, of all the subjective symptoms of disease, in five others suffering chiefly from

¹ September, 1888.

gastralgia there was noticeable a slight amelioration of the symptoms, but in no sense a disappearance of the same. In all these cases the galvanic current was afterward successfully applied.

A detailed description of all of them is given under the following heading of Galvanization.

B. Direct Galvanization of the Stomach.—The investigations made in regard to direct gastro-galvanization are very few, for the reason that direct gastro-electrization has been until lately applied only rarely, and then usually the faradic current was administered. On direct gastro-galvanization there is in literature only one detailed contribution, by Bardet.¹ This author has treated one case of nervous vomiting and three cases of dilatation of the stomach, combined with symptoms of atony, with the constant current by means of a stomach electrode designed by himself.

In the case of nervous vomiting a remarkable amelioration ensued after three weeks of galvanization (the positive pole being in the stomach); the pains, however, remained just the same as before. In the three cases of dilatation the constant current was applied with frequent interruptions. In all these cases there was an improvement in stomach digestion, notwithstanding that the size of the stomach did not noticeably change.

As stated above, I have tried the application of the galvanic current in several cases in which faradization did not prove of much benefit, and have had good results. I refer to five cases of severe gastralgia from various causes (as will be seen from the histories); no therapeusis proved of any value, and even faradization was without effect, galvanization alone bringing benefit. I may be allowed to relate these cases in full, as they were reported in the *New York Medicinische Monatsschrift* (September, 1891).

1. Augusta K——, twenty-two years of age, school-teacher, began treatment October 25, 1890. Patient

¹ Bardet : Bull. Gén. de Thérap., 1884, t. 106, p. 529.

complained for several months of having severe pains after meals ; she has also become much weaker of late ; from time to time there were attacks of pain of very intense character.

Examination showed the color of the lips and of the mucous membranes to be somewhat pale ; at the apex of the heart there was a slight systolic murmur ; the heart was not enlarged ; pulse accelerated. Nothing abnormal could be detected in the lungs. The gastric region is sensitive on pressure, this being more noticeable at the epigastrium ; the lower contour of the stomach is situated somewhat (one finger) above the umbilical line. The urine contains neither albumin nor sugar.

Examination of the stomach contents on October 26, 1890, two hours after the test-breakfast, showed : HCl + ; acidity = 34.

Diagnosis : *Insufficiencia mitralis* ; *gastralgia nervosa*. The patient was gastro-faradized internally from January 1 to January 10, 1891, but without any special result. Codeine and phenacetin, which were given to combat the pains, were without effect.

January 23, 1891. Direct galvanization of the stomach (negative pole in the stomach, strength of the current being 15 to 20 milliampères) was administered every third day up to February 4th ; thereafter once a week up to March 4th, on which day the cure was considered as finished.

After the first galvanic sitting the patient reported that the pains became slighter and the attacks less frequent. On February 4th the patient said that she had been free from pains since the last galvanization. She gained in weight thereafter, and has had no pains thus far up to date.

2. The history of patient, H. F——, thirty-five years of age, clergyman, has already been partially reported by me. Three years ago I presented this patient at the German Medical Society of New York as a typical case of *gastrosuccorrhœa continua chronica*, and published the

same in the *New York Medicinische Presse*, September, 1888. The patient at that time had been sick for four years. In reference to the condition of his disease I said at that time, that, notwithstanding the constant vomiting had been successfully stopped, and the patient had been brought into a much better condition by the rational treatment (lavage of the stomach, alkalies, and suitable diet), the sickness as such, the continuous flow of gastric juice, however, had not been relieved.

In the above paper I said: "Objectively I have been able to note a diminution of the quantity of fluid found in the stomach when fasting; but I have not succeeded in reducing the excessive secretion of the stomach to the normal." From September, 1888, to December, 1890, the condition of the patient, who was all the time under my observation, remained the same; there was always found in the stomach when fasting a certain amount (40 to 80 c.c.) of gastric juice containing hydrochloric acid and the specific ferments of the stomach (pepsin and rennet). During all this time the patient was never free from pains, although they were not of an intense character. In the year 1890 the pains began to increase; they were principally in the epigastric region and radiated to the back. On account of his pains the patient could not lie on his left side, and complained of a very restless sleep. The cough, which appeared in the middle of 1889, then became more intense and frequent, although nothing could be detected abnormal in the lungs. Palpation of the gastric region caused pain. Chloral hydrate produced but little influence on the pains, and bromide of sodium, which the patient took for quite a while, had diminished the cough but not the intensity of the pains.

During November and December, 1890, direct gastrofaradization was applied, but this, likewise, did not have the desired effect. For this reason, in the beginning of January, 1891, direct galvanization of the stomach was administered first twice a week and thereafter only once a week. At the end of February last the galvanic treat-

ment was discontinued. Immediately after the first galvanic séance the pains became much slighter than ever before; after a few more sittings the intense pains the patient used to complain of before ceased entirely. In March last it was noticed that the stomach of the patient was empty when fasting, something that had never before happened during the three years of treatment. Since that time the patient has often been examined when fasting, and there was always the same result found, namely, the stomach was empty. Thus far the pains have not reappeared, and the patient is better and healthier in appearance, and has gained several pounds in weight. Thus the previous condition of continuous flow of gastric juice has not existed since March last, and it is interesting to ascertain the chemical condition of the stomach at present. An examination of the stomach contents, made for this purpose, in May, 1891, one hour after the test-breakfast, proved the presence of hydrochloric acid and an increased acidity (= 120).

In this way we see that the previously found hyper-acidity persisted, although the abnormal secretion of gastric juice during the time that there is no food in the stomach, has disappeared. Whether this favorable turn has been brought on by direct galvanization is hard to tell, although there are no other apparent circumstances by which the sudden change in the condition of the stomach secretion could be explained, except the direct galvanization.

On account of the persistent cough the patient was sent to Dr. W. Freudenthal, of this city, who found a lingual tonsil and an elongated uvula. The patient was treated accordingly, and although the cough did not disappear entirely, it is now much easier.

I may be allowed to remark that this is, according to my knowledge, the first case of gastrosuccorrhœa continua chronica mentioned in literature which was cured with cessation of that anomalous action.

3. Charles J——, aged twenty-one, merchant, com-

plaints for three months of having pain immediately after eating, by reason of which he is prevented from partaking of a sufficient quantity of food ; there was vomiting once in a while ; bowels constipated. Patient has become thinner and feels weak ; he coughs from time to time, and is uneasy about his lungs.

July 9, 1891.—Physical examination shows thoracic organs normal ; sensitiveness on pressure over the region of the stomach ; no enlargement of the stomach can be discovered ; the urine is free from sugar and albumin. On account of the weakness of the patient, pills of iron and strychnine were given at first.

July 10, the stomach contents were examined one hour after the test-breakfast by means of the stomach-bucket : $\text{HCl} +$; ten times diluted + ; fourteen times diluted = 0. The chemical function of the stomach is not markedly disturbed ; the acidity being only little above the normal limits.

Diagnosis : Gastralgia of nervous origin in combination with anæmia.

The patient was gastro-faradized internally every other day for a week, but without any apparent result ; he still complains of being unable to partake even of a small meal ; besides, he has often acid eructations. In addition to the pills the patient was advised to take, if necessary, three times a day, half a teaspoonful of a powder, consisting of *sodii bicarb.*, *elæosacch. menth. pip.*, *aa* equal parts. This powder gives the patient some relief, although his condition, as such, has not altered. He went to Washington on a business trip, and returned after a week, complaining of his previous troubles, besides of being restless and excited and sleeping poorly.

July 24th.—Sodium bromide was given, and direct faradization of the stomach was resumed, electricity being applied on July 24th and 27th. He, however, noticed but little amelioration, and was unable to eat sufficiently.

As the faradic current did not seem to achieve much

in this case, direct gastro-galvanization was resorted to on July 29th. The negative pole was introduced into the stomach, the other (positive) electrode was placed beneath the ensiform process, a little to the left, for five minutes, thereafter for three minutes on the left side of the spine, over the sixth dorsal vertebra, and then again for two minutes in front. The strength of the current was 20 milliampères.

On August 1st the patient reported that he felt much better after the galvanization, and, what could be noticed most markedly, he could eat well, without having pains afterward; he was galvanized once more in the same way. The pills were discontinued. The patient subsequently caught cold and suffered from a pharyngitis, and in order to avoid an irritation of the throat the galvanization was omitted until August 8th, on which day the throat appeared well again. On August 8th and 10th gastro-galvanization as described above. Meanwhile the condition of the patient was highly ameliorated; he ate, to use his own expression, "like any other man," and had no pains whatever. He had a much better appearance, the cure was considered as finished, and the patient went to the mountains for his vacation.

In November last he reported that he had been all right since the electrical treatment.

4. June 15, 1891.—Miss Ida S——, twenty-seven years of age, began to have pains in the gastric region, especially after meals, six years ago. There was vomiting from time to time, and loss of appetite. The condition of the patient was somewhat improved after a sea-voyage to Germany. While there, however, the condition grew worse in 1887; vomiting of blood came on, and the patient was treated for ulcer at Frankfort-on-the Main. She felt somewhat better and returned to New York in 1889. While at sea she got worse and had several spells of vomiting of blood. Since that time the patient has suffered all the time, with only short intermissions, from entire loss of appetite, pains directly after each meal, and

very frequent vomiting. The attacks of pain were often unbearable and the patient was frequently obliged to take refuge in morphine and alcoholic drinks, although even this means did not give her much relief. She is emaciated to a high degree.

Status præsens: Pain on pressure in the epigastric region; the stomach is deeply situated, from one to two fingers' breadth below the navel; there is splashing; the right kidney is movable.

June 26, 1891.—One hour after the test-breakfast: HCl +; acidity = 24.

Diagnosis: Enteroptosis; gastritis glandularis chronica; cicatrized ulcer; gastralgia.

Treatment: Tr. nuc. vomic., aq. amygdal. am., āā equal parts. M. S.: Fifteen drops, t. i. d., twenty minutes before meals. Sodii bromidi, 8.0; aq. menth. pip., 60.0. M. S.: A teaspoonful morning and evening.

[Tr. ferr. aromat. (Pizzala), two teaspoonfuls three times a day, had to be discontinued, as this preparation did not seem to agree with the patient.]

From June 16th to July 8th, direct gastro-faradization was applied every other day. On July 6th the patient began to take acid. mur. dil., twelve drops t. i. d.

Although direct faradization of the stomach had decreased the severe attacks of pain, they nevertheless persisted, and there was still the highest degree of anorexia. The patient could force herself to partake of only the smallest amount of nourishment, and even then vomiting ensued once in a while. On July 8th she again had a very severe attack of pain, and as the remedies given (bismuth and phenacetin, āā 0.4; codeine, 0.01, t. i. d.) did not bring much relief, on July 10th direct galvanization of the stomach was resorted to. From July 24th the galvanization was applied regularly every other day.

After the first electrical sitting the patient could eat more, the vomiting stopped, and the pains soon ceased entirely. One week after the galvanic treatment the

patient had a better appearance and reported that her appetite was good and that the food agreed with her quite well ; the previous nauseous feeling and the pains were absent.

July 24th, the patient was sent to the mountains. On August 24th she reported that she had gained four and a half pounds. The severe attacks of pain did not reappear during all this time, although the patient has still a feeling of uneasiness after meals lasting for about an hour ; she is obliged to keep quiet during this time, and the process of digestion can proceed fairly ; there is no vomiting.

Examination of the stomach contents on August 26th, one hour after the test-breakfast shows : HCl + (traces) ; acidity = 30 ; rennet ferment +.

The galvanization was continued once a week during October and the first part of November, and then stopped. The patient meanwhile had gained several pounds and felt very well ; she fully enjoys her meals and has no pain.

5. Th. G. H——, thirty-seven years of age, engineer, was always well until eight years ago, at which time he had to undergo an operation for an anal fistula and was etherized. A few days after this operation the patient began to have pain in the scorbiculum soon after meals. The appetite was good. The heart-action was irregular, and he became ill-humored. Three years ago his condition improved ; but in April, 1891, a deterioration ensued after he had been to a festival. There was oppression, especially after meals ; very frequent eructations (after which the patient felt better), the bowels were irregular ; heart-action irregular from time to time. Appetite good. The main complaint of the patient refers to intense pains appearing in the gastric region, usually after meals, but sometimes, at irregular times, there is also frequently an apparent cessation of the heart-beat and in connection with it a sensation of extreme fear.

Status præsens : At the right manubrium sterni a sys-

tolic murmur is audible ; the pulse is intermittent at long intervals. Stomach dilated ; splashing is heard down to a point one finger's breadth below the navel. The gastric and epigastric regions are sensitive to pressure.

July 22, 1891.—One hour after the test-breakfast examination by means of the tube (only a small amount of material was removed and it was tinged with blood) : HCl + ; acidity = 4.

Diagnosis : Dilatatio ventriculi with erosions (perhaps ulcer) ; intense anæmia ; it is a question whether the murmur is caused by the anæmic condition or by aortic stenosis ; gastralgia.

Treatment : Pizzala, gymnastics, rowing, bathing ; direct gastro-faradization every other day from July 23d to July 31st. The patient felt better ; the pains were easier and the intermission of the heart-beat appeared less frequently. Notwithstanding this there was still always a sensation of oppression after meals, and from time to time the old attacks of pain returned, although less frequently than before.

The stomach was examined again on July 31st, one hour after the test-breakfast. On account of the erosions present the tube was avoided, and the contents obtained with the stomach-bucket : HCl + ; dilution twelve times +. The acidity was therefore somewhat increased, and the following powder was administered : Magnes. ust., 5.0 ; bismuth subnitr., 10.0 ; sodii carbon. et bi-carbon., sacch. lact., āā 15.0. Half a teaspoonful three times a day, two hours after meals.

Instead of faradization, direct galvanization of the stomach was applied every other day from August 2d, to 14th. The patient reported on August 4th that the pains had considerably decreased and that there was less oppression after meals ; after the first week of galvanization the pains entirely disappeared. The intermission of the heart beat was not noticed, and on auscultation, I was not able to distinguish the murmur previously present at the manubrium sterni. The epigas-

tric region was but little sensitive to pressure and in no way painful.

August 14th, the patient said that he had never felt as well during the three years of his sickness as during the last few days.

An examination of the stomach contents one hour after the test-breakfast, by means of the stomach-bucket, on August 14th, showed HCl + ; five times diluted + little ; eight times diluted = 0. Thus the acidity was somewhat diminished.

The patient was dismissed from treatment as considerably ameliorated, and sent to the seashore for further recreation and recuperation. He returned to the city in October, having gained eight pounds in weight, and now has no complaints.

Although the five above-described cases are quite different from each other as regards the type of disease, they all, however, have one point in common, namely, a severe gastralgia, which resists every kind of treatment ; the gastralgia, however, is the symptom which chiefly troubles the patient, and, as time goes on, seriously endangers his subjective and objective welfare. In all these cases the constant current, applied to the stomach-walls, brought much benefit, and this in quite a short time ; the gastralgia succumbed to the influence of galvanization. This was the reason why in the two following cases of severe gastralgia I applied direct gastro-galvanization at once, without having first tried the faradic current.

6. Dr. L. R.— came under treatment October 14, 1890, complaining of attacks of pain after eating, which had existed for some days. Patient examined : chest normal, stomach not dilated, the epigastric region sensitive to pressure. On October 15th, the contents of the stomach were examined by means of the stomach-tube, one hour after having taken the test-breakfast : Reaction acid ; HCl = 0 ; Rennet +.

As regards diagnosis, an ulcer was not believed to be

present, but the trouble considered to be one of nervous character, as a result of mental overwork. Patient was given HCl, and on the 16th was faradized; on the 18th he stated that he obtained no relief from the faradization. From this date I did not see the patient again until January 29, 1891; he stated that at first he felt pretty well, but since the end of December had felt very bad; every day he would have two or three attacks of very severe pain, beginning in the scorbiculum and extending from there to the back. He was able to cut short an attack occasionally by taking food. He had been taking powders of bismuth, codeine, and belladonna, without obtaining any relief. He was somewhat emaciated as a result of the pains and the small amount of food taken.

An examination of the contents of the stomach showed a slight hyperacidity—with this exception the examination gave the same results as on October 14, 1890.

The diagnosis of gastralgia, made on October 14, 1890, was substantiated by the fact of the alternating character of the acidity. [February 25, 1891, one hour after the test-breakfast: HCl +; acidity = 96.]

We advised the patient to have direct galvanization of the stomach applied. The gentleman did not place much confidence in electricity (especially since direct faradization had benefited him but little), but was persuaded to submit to the treatment. From February 5th to the 13th he received the constant current every other day; then every third day until the 28th; during the month of March it was only applied once a week, and after that it was omitted entirely.

The method of applying the current was the same as in the preceding case—negative pole in the stomach; strength of current, 15 to 20 milliampères; duration, ten minutes.

The progress of the case was as follows: After the first galvanization the patient stated that his pains continued, but were not as severe; after the second and third the number of attacks was diminished and the

amount of pain was less severe; after the fifth application the pains had almost entirely disappeared; in the latter part of February they returned only once or twice, and were not at all severe. After this they did not return. The patient could eat well, his appearance was better, and he considered himself perfectly well. I deemed it advisable to apply galvanism once a week throughout the month of March, although the patient no longer complained of pains. He has enjoyed perfect health since then and has remained free from the attacks of gastralgia. Dr. L. R—— returned on December 1st and stated that for the past three weeks he had had exacerbations of pain, similar to those of a year ago, though less severe. Galvanism was begun at once and the probability that the duration of the affection will be shortened is shown by the fact that the symptoms have been already somewhat relieved.

My reason for selecting the negative pole for introduction into the stomach is that the cathode is understood to produce a stimulating action. In the majority of the cases treated by me I presupposed a diminished function, either of the secretory nerves or of the nerves which control the carrying along of the contents. Furthermore, the positive pole relieves pain, and so this was placed on that part of the skin where the pains were most severe.

7. August 10, 1891.—Gustav L——, aged twenty-six; always felt well until September, 1890, when he suddenly became sick, with loss of appetite, diarrhœa, and cramps; for five days he was not able to eat hardly anything; in about three or four weeks he was better, in so far that he could eat. Until January, 1891, the patient felt well, then he began to suffer from eructations, especially in the morning, poor appetite and pains in the gastric region. The pain began in the scorbiculum and radiated to the back. The condition has remained the same up to date. After meals the pain was not increased, except when the patient had partaken of a large amount of food. The patient lost considerably in weight and was quite weak.

August 10, 1891.—Status præsens : Thoracic organs normal ; epigastric region sensitive to pressure ; the lower contour of the stomach is supposed to be situated in the umbilical line, as splashing can be produced down to this limit.

Diagnosis : Dilatatio ventriculi ; gastralgia ; ulcer(?).

August 22d.—The contents of the stomach were obtained one hour after the test-breakfast, on account of the doubtful ulcer, by means of the bucket : HCl + ; five times diluted + (traces).

The patient was gastro-galvanized internally every other day from August 15th to 23d, thence to the end of September twice a week, and thereafter once a week until October 19th.

September 9th. —The patient reported that he had not had any pains since September 5th. The appetite was good and he felt generally much better than a fortnight ago. During the remaining time of treatment the patient had almost no pains whatever and gained three pounds in weight.

To my cases of severe gastralgia treated by direct gastro-faradization the following case, treated by Dr. Alfred Meyer, of this city, may be added.

Dr. Alfred Meyer was kind enough to send me a full report of his case and I may be allowed to publish the same with Dr. Meyer's own words. He wrote to me as follows :

"I saw the patient for the first time on September 11, 1891. He was twenty-eight years of age, intelligent, of rather a nervous type and light build. His sickness had begun about seven years before, rather suddenly, after taking a glass of ice-water while overheated. His complaint consisted of periodic attacks of intense pain in the epigastrium, accompanied or unaccompanied by vomiting. Originally there had been long intervals of good health between the attacks, but these intervals of comfort had grown shorter and the duration of the attacks longer. Present attack had begun in January of the present year.

Patient had taken to bed in May, where he had been almost continuously, up to the time of my seeing him. During these years the treatment had included a very large proportion of the remedies usually administered in gastric diseases, whether of a functional or of an organic nature. They had been given singly and combined, allopathically and homœopathically. They included: Bismuth, bicarbonate of soda, pepsine, lactopeptine, muriatic acid, iron, iodoform, nitrate of silver, arsenic, belladonna, morphine, codeine, creasote, hypophosphites, nux vomica, tannin, charcoal. In addition, various forms of counter-irritation, external galvanization, rectal alimentation, and, some years ago, a few washings by siphonage. The patient describes the pains as radiating into the right and left hypochondrium, and into the back between the shoulder-blades. The pain was either lancinating or boring or grinding, and accompanied frequently by a feeling as though somebody were playing the piano on the patient's stomach. There seemed to be no relationship between the pain and the introduction of food into the stomach; in fact, there would frequently be distinct relief after eating or drinking. The vomiting had usually been of large quantities, according to the patient's statement, had never contained blood, but often remnants of food taken as much as twelve hours before the vomiting.

"Physical examination showed heart and lungs normal, liver and spleen normal, tongue heavily coated, slight sensitiveness to pressure in the epigastrium, slight gleety discharge from the urethra. Light percussion seemed to indicate the existence of a moderate gastrectasia. Under the supposition that there was a stenosed pylorus from an old ulcer at that site, with secondary dilatation, feeding by the mouth was stopped, and the patient was placed, beginning September 12th, upon deep rectal alimentation with peptonized milk, a mixture of meat pulp and sweetbread, and afterward of milk and whiskey. This was kept up for five days, during which time nothing was allowed to pass the patient's mouth except a few tablespoonfuls

daily of an infusion of cundurango. There was a daily recurrence of pain, commencing usually after 1 P.M., gradually increasing in violence, and toward evening the patient would be found grinding his teeth and tossing restlessly from pain. He received daily an injection of morphine and atropine.

"On September 17th gradually increasing quantities of milk with lime-water or barley, by the mouth, were commenced, combined with rectal alimentation; later Mellin's food, sweetbread, and wine-jelly, and finally rectal alimentation was entirely withdrawn. The morphine injections were kept up in diminishing doses until October 3d. During a portion of this period the patient received varying quantities of tinct. belladonnæ, without marked benefit, though the amount taken was at no time sufficient to produce distinct physiological effects. A solution of bromide of soda was also tried, because of a growing conviction that the patient was suffering primarily from a neurosis of the stomach. On September 24th, the patient was given a test-meal of a French roll and a cup of tea without milk. On this occasion he was seen in consultation by Dr. Einhorn. The expressed stomach contents were found to contain an abundance of free HCl, an acidity of 160, being nearly three times the normal. On September 26th, galvanization with Einhorn's deglutable stomach electrode was commenced, strength of the current 14 milliampères. Daily sittings after that until October 26th; duration from fifteen to twenty minutes, strength from 13 to 29 milliampères. After the first week of galvanic treatment the injection of morphine was stopped entirely, the patient being nearly free from pain. Some of the credit for this result may possibly be due to a solution of cocaine and belladonna employed at the same time, but it is only fair to say that there was a continuance of the favorable condition under galvanization alone, the use of the anodyne mixture having been practically suspended. October 8th, 10th, and 12th, small hypodermics were again required. In view

of this recurrence, a solution of atropine was ordered, and continued until October 21st. After October 26th galvanization was employed on alternate days only, namely, October 27th, 29th, and 31st, the patient feeling sufficiently convalescent to permit his walking to the sofa, and spending a few hours there, daily. The interval was then prolonged, no current being applied November 1st, 2d, and 3d. On the third, he began to have 'crampy' pains again, which culminated in an attack of vomiting at 7 P.M., and again at 1.35 A.M., November 4th, this time amounting to a pint and a half of mainly fluid material. In view of this episode of pain and vomiting (the latter being the first he had had since he had been under my observation), I determined to resume the treatment by galvanization, and the patient had sittings on the 4th, 5th, 6th, 7th, 8th, and 9th, which concluded this method of treatment, for the patient had attacks of vomiting November 9th—1 A.M., half pint; 3 A.M., one pint and a quarter; 8 A.M., one quart; 3.30 P.M., one pint and three-fourths, and required a morphine injection on the evening of the 9th. On the morning of November 10th daily lavage of the stomach was commenced, and on this occasion some bits of prunes were found in the wash-water that must have been in the stomach nearly forty-eight hours. On this date the patient received his last hypodermic. In addition to the daily lavage, he has been receiving Fowler's solution, and a solution of bromide of soda and chloral t.i.d. He is on a very liberal diet, is up the entire day, feeling well and anxious to go out and resume his ordinary routine.

"With reference to the employment of internal galvanization in this case, though it did not prove curative, it was, in my judgment, distinctly beneficial, in spite of the scepticism of the patient, who had had external galvanization without any improvement, before I had seen him, and was therefore rather averse to its application by this modified method. The introduction of the electrode into the stomach and its removal were always accomplished by the

patient himself without the slightest difficulty or annoyance."

In reference to the therapeutic results of direct electrization of the stomach I might be allowed to give the following *résumé* :

Direct gastro-faradization proves to be useful in many ways in most chronic diseases of the stomach. The favorable results appear very clearly and pretty quickly in those cases of stomach dilatation which are not caused by any obstruction of the pylorus, but merely by the relaxation of the muscular coat of the stomach. Here the gastro-faradization is beneficial, no matter whether in these cases there is hyperacidity or subacidity of the stomach contents. Cases of relaxation of the cardia (eructations) and also of relaxation of the pylorus (presence of bile-secretion in the stomach) were very favorably influenced by faradization. Here the result was most markedly pronounced, inasmuch as, besides the subjective amelioration of the patient, the objective examination showed at the same time the absence of bile in the stomach-contents (there was, however, only one case of relaxation of the pylorus under observation).

Direct gastro-galvanization was administered with very good results in cases of obstinate gastralgia; several of them had resisted every therapeutic means, but yielded to the influence of galvanization.

